**Ministry of Transport**

**Department of Civil Aviation**

# MYANMAR PBN IMPLEMENTATION PLAN

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## 1. INTRODUCTION

1.1. ICAO Asia/Pacific Air Navigation Planning and Implementation Regional Group, APANPIRG, adopted several conclusions to promote the uses of Performance-Based Navigation (PBN) and Global Navigation Satellite System (GNSS) as the navigation elements of CNS/ATM systems. These navigation technologies and specifications have promising potentials to provide accurate, reliable and seamless position determination and navigation capabilities to airspace users.

1.2. Introduction of PBN specifications and GNSS technology facilitate more efficient use of airspace and more flexibility for procedure design. They cooperatively result in improved safety, access, capacity, predictability, operational efficiency, fuel economy, and environmental effects.

## 2. WORKING TEAM FOR PBN AND GNSS IMPLEMENTATION

2.1. Recognizing the benefits of PBN and GNSS implementation prescribed in Asia Pacific PBN Implementation plan, Myanmar has set up the working team comprising relevant stakeholders for studying on PBN Implementation.

2.2. The Working Team is responsible for developing policy, implementation plans, and implementation standards for the deployment of PBN and GNSS procedures and operations in Myanmar airspace. It adopted three areas of responsibility in regards to the implementation of PBN and GNSS in Myanmar airspace. The three areas of responsibility are:

- Policy & Implementation Planning (Area 1)
- Establishments of Standards and Requirements in accordance to appropriate ICAO requirements (Area 2)
- Communication with Stakeholders (Area 3)

## 3. STATUS OF RNAV OPERATIONS AND PBN IMPLEMENTATION IN MYANMAR

3.1. Nine RNAV routes were established in Myanmar during implementation of EMARSSH routes programme. Domestic routes have not been designated as RNAV so far. Terminal and Approach operations were not being conducted till 2010 at any of the airports in Myanmar.

3.2 Currently available navaid infrastructure within Myanmar supports terminal operations using DME/DME or DME/DME/IRU sensors for RNAV 1/2 or Basic RNP 1 navigation applications. Sufficient surveillance coverage is available in TMAs established around two major international airports. RNAV1 using GNSS sensor will support terminal operations in these TMAs.

However, Basic RNP-1 applications will be implemented at all other airports where no suitable surveillance is available.

3.3. Currently onboard GNSS equipage is available on limited aircraft. As such benefits of RNAV1 and Basic RNP1 using GNSS will be limited to few aircraft.

3.4. Based on the above considerations, RNAV 5 is envisioned as primary navigation application for enroute operations continental airspace in Myanmar utilizing any allowable sensors. However, GNSS

would be the primary sensor for all terminal and approach applications. Due to existing limited GNSS equipage and in order to facilitate the capable aircraft, ANSP have to support mixed environment for a prolonged period.

### 3.5. Aircraft Fleet Equipage

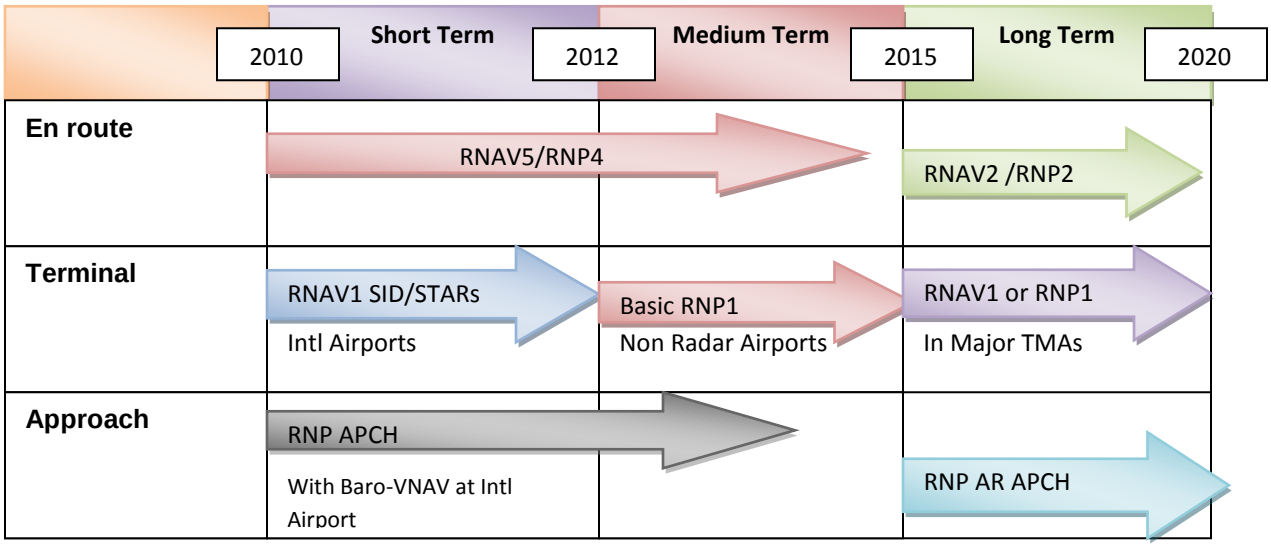
As at February 15, 2011 there are approximately 24 aircraft with PBN capability on the Myanmar Aircraft Register. This is a significant proportion of the IFR capable fleet. However there is a diverse range of navigational capabilities of the aircraft operating in Myanmar airspace. The following table indicates the estimated state of PBN technical capability of major scheduled carriers in Myanmar as of February 2011:

Figure 1 - Current Estimated Airline Fleet PBN Capability

| Aircraft Type | No of Aircraft | RNAV 2/ 1 | RNP APCH Basic RNP 1 | RNP AR APCH | APV (Baro-VNAV) |
|---|---|---|---|---|---|
| A320 | 4 | 100% | 100% | 100% | 100% |
| F100 | 2 | 100% | 100% | 0 | 0 |
| FK28 | 3 | 100% | 0 | 0 | 0 |
| ATR72 | 9 | 100% | 100% | 0 | 0 |
| ATR42 | 3 | 100% | 100% | 0 | 0 |
| MA60 | 3 | 100% | 100% | 0 | 0 |

## 4. PBN & GNSS NAVIGATION SPECIFICATION ROADMAP

4.1 To assist planning and to assure proper equipages by aircraft operators, Myanmar has established a Navigation Specification Roadmap for PBN & GNSS Implementation over Yangon FIR. The Roadmap is consistent with the interim Asia/Pacific Regional PBN Implementation Plan adopted by ICAO APANPIRG/19.



# 5. Airspace Concept

An airspace concept may be viewed as a general vision or a master plan for a particular airspace. Each airspace concept is based on an agreed set of principles that support the achievement of specific objectives. The strategic objectives which most commonly drive airspace concepts are safety, capacity, efficiency, access and the environment.

## 5.1 Key Airspace Concepts

The agreed concepts for Myanmar will be implemented through a three-phase process that will deliver incremental improvements to:

- Safety improvements (through more precise trajectory management & CDO that support the ICAO strategy to address CFIT accidents)
- Predictability and repeatability
- Efficiency (min air distance / optimum aircraft determined profile)
- Minimizing environmental impact (eg from carbon dioxide, oxides of nitrogen and noise)
- Maximizing capacity utilization (aerodrome & airspace)
- Higher aircraft utilization (sectors flown per day)
- Schedule reliability
- Cost effective investment
- Minimized quantity of CTA and optimized design

All ATS routes (including SIDs and STARs) will be enabled by RNAV (or RNP, where required):

All runway ends with instrument approach procedures will be enabled by RNP (with APV where possible based on Baro-VNAV).

## 5.2 Operational Concept for Short Term

During this phase the operational concept will be a mixed-mode navigation environment that allows continued use of conventional navigation applications while PBN capability is progressively implemented in aircraft fleets and the supporting infrastructure. The benefits to operators will be limited by the diversity of navigation performance and the ATM system's ability to manage this diversity. The ground infrastructure associated with conventional navigation systems will be reviewed and progressively adapted to reflect the progress made on implementation of PBN. General aviation VFR flight access to CTA will not be subject to any additional restrictions during this phase.

### 5.3 Operational Concept for Medium Term

During the Medium Term Phase the operational concept will move to a more exclusive PBN environment that places greater reliance on the level of PBN capability in the national fleet and infrastructure. This change will enable further realization of the goals outlined in para 5.1. The ATM system will be managing a more homogeneous navigation capability and have greater ability to minimize the negative impact of aircraft that lack required navigation performance capability. General aviation VFR flight access to CTA may be restricted during periods of capacity constraint but only to the extent needed to ensure that the flight paths of PBN capable flights are not restricted.

### 5.4 Operational Concept for Long Term

During this Phase, the operational concept will be a mature PBN environment with a comprehensive fleet and infrastructure capability that delivers the fullest expression of the airspace concept and goals outlined in para 5.1. A mature set of ATM tools will complement the airborne systems and will also enable the effective management of those aircraft that may experience a temporary loss of PBN capability without significantly impacting other airspace users. General aviation VFR flight access to CTA may be restricted during periods of capacity constraint but only to the extent needed to ensure that the flight paths of PBN capable flights are not restricted.

## 6. IMPLEMENTATION

### 6.1 Route Implementation

During 2010-2012, Myanmar will consider the use of RNAV 10, RNAV 5, and RNP 4 navigation specifications for PBN route implementations. Some existing domestic conventional ATS routes will be modified towards PBN routes, while additional domestic and international RNAV and RNP routes may be introduced. Designation of upper and lower airspace will also be considered to assist PBN enroute implementation during the transitional period.

6.2 The following existing RNAV Routes are being considered for initial PBN route implementations:

| RNAV Routes | Airspace | Navigation Specifications for PBN Route | Expected Operation |
|---|---|---|---|
| L507 | Continental Airspace | RNAV5 | 2012 |
| P646 | Continental Airspace | RNAV5 | 2012 |
| N895 | Continental Airspace | RNAV5 | 2012 |
| M626 | Continental Airspace | RNAV5 | 2012 |
| L301 | Oceanic Airspace | RNAV5/RNP4 | 2012 |
| P762 | Oceanic Airspace | RNAV5/RNP4 | 2012 |
| M770 | Oceanic Airspace | RNAV5/RNP4 | 2012 |
| L759 | Oceanic Airspace | RNAV5/RNP4 | 2012 |
| L515 | Oceanic Airspace | RNAV5/RNP4 | 2012 |

### 6.3 Terminal Area and Approach Implementation

Myanmar establishes the following PBN implementation schedule to increase safety and efficiency of terminal area and approach operations.

| Implementation Activities Starts | Terminal Areas | Target Navigation Specifications | | Expected Operation Date |
|---|---|---|---|---|
| 2010 | VYYY (Yangon Intl Airport) | Approach | RNP APCH (Baro VNAV) | 2012 |
| | | SID | RNAV1 (DME/DME/IRU) or GNSS | 2012 |
| | | STAR | RNAV1 (DME/DME/IRU) or GNSS | 2012 |
| 2010 | VYMD (Mandalay Intl Airport) | Approach | RNP APCH (Baro VNAV) | 2012 |
| | | SID | RNAV1 (DME/DME/IRU) or GNSS | 2012 |
| | | STAR | RNAV1 (DME/DME/IRU) or GNSS | 2012 |
| 2010 | VYNT (Nay Pyi Taw Intl Airport) | Approach | RNP APCH (Baro VNAV) | 2012 |
| | | SID | RNAV1 (DME/DME/IRU) or GNSS | 2012 |
| | | STAR | RNAV1 (DME/DME/IRU) or GNSS | 2012 |
| 2010 | VYBG (Bagan Airport) | Approach | RNP APCH (Baro VNAV) | 2013 |
| | | SID | Basic RNP1 | |
| | | STAR | Basic RNP1 | |
| 2010 | VYHH (Heho Airport) | Approach | RNP APCH (Baro VNAV) | 2013 |
| | | SID | Basic RNP1 | |
| | | STAR | Basic RNP1 | |

6.4 Basic RNP1 SID and STAR procedures will be implemented at other domestic airports also in a phased manner.

### 7. Safety Assessment and Monitoring

Conduct safety assessment before and after PBN implementation to ensure that proper level of safety is achieved and maintained.

### 7.1 Safety – Risks Associated with Major System Change

During the transition to a mature PBN environment the government and airlines industry will face significant challenges. The government challenges will include support of Civil Aviation Rule changes and associated preparatory work. The airlines industry challenges will involve resourcing and managing a diverse range of navigation systems with equally diverse requirements. Some of the key identified challenges are:

- Adoption of supporting Civil Aviation Rules
- PBN capability register and aircraft minimum equipment lists (MEL)
- Integration of PBN capability into the ATM system (Flight Plan data fields)
- Mixed fleet/system operations
- Safety monitoring of ATM system
- Approach naming and charting conventions
- Navigation database integrity and control
- GNSS system performance and prediction of availability service
- Continued involvement in CNS/ATM and PBN development
- Resources of the DCA, Airlines to implement PBN
- Education and training of personnel employed by the DCA, Airways and aircraft operators

## 8. Benefits and Global harmonization

8.1 **Performance Based Navigation** is a framework for defining a navigation performance specification along a route, during a procedure, or in airspace within which an aircraft must comply with specified performance requirements. It provides a simple basis for the design and implementation of automated flight paths and for airspace design, aircraft separation, and obstacle clearance. Once the performance level is established on the basis of operational needs, the aircraft's own capability determines whether the aircraft can safely achieve the specified performance and thus qualify for the operation.

8.2 RNAV and RNP specifications facilitate more efficient design of airspace and procedures, which collectively result in improved safety, access, capacity, predictability, operational efficiency, and environmental effects. Specifically, implementation of RNAV and RNP in accordance with PBN concept will:

- Increase safety by using APV operations with perfect course guidance to the runway, which reduce the risk of controlled flight into terrain.

- Improve airport and airspace access in all weather conditions, and the ability to meet environmental and obstacle clearance constraints.

- Enhance reliability and reduce delays by defining more precise terminal area procedures.

- Optimum utilization Flight management systems (FMS) poised to save operators time and money by managing climb, descent, and engine performance profiles more efficiently.

- Improve efficiency and flexibility by increasing use of operator-preferred trajectories at all altitudes.

- Reduce workload and improve productivity of air traffic controllers.

- Reduce environmental impact as with shortening published routes and optimum fuel profile due to airspace capacity enhancement as well as using new techniques such as CDO/CDFA, greenhouse gasses (CO2, etc.) will also be reduced during all operations including enroute, terminal, and approach procedures.

- Reduce noise exposure by avoiding populated areas and other noise sensitive areas by departures, arrivals, and approach procedures developed to help the community in the airport surroundings.

- Result in global harmonization of RNAV/RNP criteria thus facilitating all stake holders of aviation community.